been established, in 1873 there were 178, so that at present there is more than one gauge to every square mile. By this system the conditions of local rainfall have been, as it were, put under the microscope; and the store of information obtained after the suggestive manner in which it has been analysed in this Report, will be not only valuable to the sugar-planter, but interesting to the meteorologist.

The north-east trade-wind prevails at Barbados during three-fourths of the year, and most of the rain comes from that quarter. Heavy showers come at certain seasons from south-west and north-west, but generally fail to reach the eastern districts. Indeed it very rarely happens that rain falls at the same time, or in equal proportions, over the whole island; it has, therefore, been divided into two main districts, the windward, and chiefly highland, and the leeward, or lowland section.

With regard to the yearly rainfall of the whole island from 1847 to 1871, it has been found, among other results (1), that the rainfall of fifteen years was above the mean, that of ten years below it; (2) that the deficiencies were generally greater than the excesses above the mean, that is, droughts, when they happen, are heavy; (3) that, taking the thirty years 1843-72, no succession of wet or dry years in cycles can be traced, but rather an alternation of wet and dry years. No more than two dry years have occurred together, but as many as three and four wet years.

With regard to the monthly rainfall: the mean of all the months is under 5 in.; March is driest, October wettest. In wet years May contributes most to the excess, March least. March is the only month of which the mean rainfall in dry years has exceeded the average. In dry years the deficiency is generally spread over the whole year; in wet years the excess is generally confined to the rainy season (autumn). On the other hand, taking the seven wettest and the seven driest years of the period, we observe that in the wet years two-thirds of the excess proceeds from heavy rains in the dry season, and that in the dry years more than two-thirds of the deficiency is caused by three out of the same four months, viz. June, July, and May, and by October and May.

A comparison between the three highest and the three lowest rainfalls belonging to each month during the whole period of twenty-five years shows a remarkable uniformity of the relation between the percentages of the extremes; thus the difference between each average of the lowest months and each average of the highest amounts in none of the twelve months to more than 90 (May) or less than 65 per cent. (August and September).

Of the two stations, Binfield and Halton, lying respectively at 1,065 and 280 ft. above the sea, the former received on an average nearly 11 in. more rain in the year, and showed a greater monthly variability. The influence of elevation is interesting. A table of rainfall in 1870 and 1871, at various heights from 100 ft. up to 1,000 ft., shows an increase at every step of 100 ft. but one, and the total increase at 1,000 ft. amounts to 20·73 in. on the mean of two years. Two exceptions to this regular increment in the means for 1871-73, in supplement No. 2, are ascribed to the lower stations catching the westerly rains, which do not penetrate far inland.

In March, one-half more rain fell at night than by day. From June to November, the days are slightly the wetter, from December to May, the nights.

One of the objects of this inquiry is to assist those who are interested in calculating the character of coming seasons. For such a purpose the annual averages of each month are taken, after eliminating the exceptional months of very great or of very slight rainfall. The original averages are not affected more than 6 per cent. by this removal. Having the ordinary limits of monthly rainfall tabulated, and observing the general appearance of the weather, every planter can form *some* conjecture whether the coming month will be wet or dry.

Appendix No. 36 shows the influence of each month according to the rainfall, upon the crop of the same year, and upon that of the following year. Thus a man might fairly bet 9 to 3 that a wet February will be followed by a bad crop, and 8 to 1, the highest odds of all, that a wet September will give a good crop next year.

A wet year is followed almost invariably by a good crop in the following year; and it is found that by multiplying the total rainfall of the preceding year by 800 and adding 7½ per cent. if that year was a dry one, or subtracting 7½ per cent. if that year was a wet one, the crop may be calculated in most instances within 3,000 hhds., the average yield of the island being 45,000 hhds. The good chance of predicting so nearly the total exports of Barbados for the coming year cannot fail to be of value, and further experience will no doubt reduce the probability of error. Let us hope that other States may be led to undertakings of the same kind by this example.

F. A. R. RUSSELL

OUR BOOK SHELF

Manual of British Botany, containing the Flowering Plants and Ferns arranged according to Natural Orders. By C. C. Babington, M.A., F.R.S., F.L.S. Seventh Edition; corrected throughout. (London: J. Van Voorst, 1874).

WE cordially welcome this new edition of a "Manual of British Botany" which continues to hold its ground against all its competitors. We do not propose to discuss the rival merits of Hooker's, Bentham's, and Babington's hand-books; each has specialities in which the others are wanting; and each will, no doubt, long have its advocates and admirers. A special claim to popularity as a *field-book* is advanced by the present work on the ground of its portability; and a great advantage is alleged by those who use it to be presented by the practice of placing in italics a few words in the description of each species referring to the character by which it is more readily distinguished from its nearest allies. Comparing the work with the most recent of the earlier editions which we have at hand—the 4th, published in 1856—we find that it extends only to twenty-six pages more, notwithstanding the numerous additions made since that time to British botany, of which ample account has been taken in the present edition. The only alteration made in the primary classification (comparing these two editions) is the separation of Cannabinaceæ from Urticaceæ. The number of natural orders is six more than in Hooker's "Student's Flora," notwithstanding the union of Salicaceæ, Myricaceæ, Betulaceæ, and Cupuliferæ into the somewhat artificial group of Amentiferæ. The location of individual genera has also been in some cases revised, as the removal of *Narthecium* from Juncaceæ (Babington, 4th ed.) or Liliaceæ (Hooker) to Melanthaceæ. Referring to some of the more difficult genera, in which Prof. Babington is

© 1874 Nature Publishing Group

an acknowledged authority, we find the number of species of *Rubus* increased from 41 to 45, while that of *Rosa* is reduced from 19 to 11, and of *Salix* from 32 to 29. We have never been able to understand on what principle Characeæ find a place in a work devoted to "Flowering Plants and Ferns," by the latter term being apparently meant Vascular Cryptogams. Prefixed to the work is a useful Glossary not found in the earlier editions; but the author has wisely refrained from acceding "to the wishes of some young botanists by prefixing a short Introduction to Botany." With the numerous admirable works now at their disposal, students ought to have no difficulty in making themselves acquainted with the Flora of the British Islands. A. W. B.

Eclipses, Past and Future, with General Hints for observing the Heavens. By the Rev. S. J. Johnson, M.A., F.R.A.S., Rector of Upton-Helions, Devon. (Parker, 1874).

THIS little book is a combination of two distinct treatises; one a description of past and future eclipses; the other, a catalogue of celestial objects falling within the range of such small telescopes as amateurs frequently possess. Each of these, it seems, was originally of greater bulk, and intended for separate publication, but they have now been condensed into a single small volume. This has the merit, not very common in these days, of being more than a mere compilation; the ancient eclipses, including those in the "Saxon Chronicle" (of which the author tells us no description has hitherto been published), having been approximately computed for the purpose from the tables in the "Encyclopædia Britannica;" and the notices of the planets, double stars, &c., being derived from actual observation. The book is pleasantly written, and without professing to go deeply into the subject, may well find readers among those who feel a general interest in astronomy, but have no intention of making it matter of serious or accurate study, or of going much beyond the limits of a 2¼ in. telescope. It would have been improved (without departing from its sketchy character) by a little more fulness and explicitness of treatment in some places; for instance, in the description of the belts and satellites of Jupiter, and where the abbreviated symbols of the Palermo Catalogue are left unexplained. Some misprints, too, have escaped in the revision. The following extract may interest our readers:—"For those who have very large telescopes, and who are not disposed to take them to oriental climates, it would be useful to have records of the number of clear nights in different parts of the kingdom. By clear nights, let us understand nights cloudless, or nearly so, till 11 P.M., or else clear for a full hour or two. Formerly my observations were taken in South Lancashire, but since the early part of 1870 in Devonshire. In 1859, the number of nights clear, partly or throughout, was 60; in 1860, 43; in 1861 and 1862, 46 each; in 1863, 47; in 1864, 83; in 1865, 82; in 1866, 77; in 1867, 55; in 1868, 62; in 1869, 58; in 1870, 112; in 1871, 98; in 1872, 90; in 1873, 82."

The Human Eye. By W. Whalley. (London: J. & A. Churchill.)

IN this small work the author tells us that he has incorporated the substance of a lecture on the subject, together with additions in various directions. He discusses, in a popular manner, the eye in man, and adds many facts with regard to its structure in other animals. His remarks are mostly anatomical, and we are disappointed to see so little notice of many physiological phenomena connected with the power of sight, which bring out the beauty of the organ of vision in a way which can be understood by the most amateur of readers. There is a want of consecutiveness in many of the paragraphs and chapters, though as a whole the book is a very readable one. Many of the instances given are wanting in grasp; for instance it is remarked that "In some of the ichneumons or 'Pharaoh's rats,' as the Egyptians call them, in the coatimundi, which somewhat resembles the racoon, and in the mangre, the osseous orbital ring is incomplete, and in a group of minor quadrupeds, entitled the Hyracidæ, the malar, or cheek bone, constitutes a perfect orbital ring." It is well known that the orbital ring is complete in all the Quadrumana and many Ungulata, and that it is absent in most other mammals; why then take the particular examples, which are not particularly good ones, and lay special stress on them. The deductions drawn are of a strongly teleological nature, and we cannot do better than recommend the author's reperusal of his work for the refutation of one of his concluding remarks, namely, that "In reviewing this very imperfect and disconnected sketch of the structure of the eyes of the different classes of animals, we cannot fail to recognise the fact that the human eye far transcends, both in mechanism and power, that of every other animal." We however deduce that the condor can see further, that many animals have an extra eyelid, and some bigger eyes than man himself, showing that his is inferior instead of superior in many respects.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

Early Contributions to Spectrum Photography and Photo-chemistry

1. MY first attempt at photographing the fixed lines of the spectrum was made in 1834. It was on paper covered with silver bromide. As mentioned in the *Philosophical Magazine*, May 1843, it proved to be a failure. In the summer of 1842, simultaneously with M. Becquerel, by using daguerreotype plates, I succeeded, and in the following March sent a drawing of the photograph to the *Philosophical Magazine*, which was published in May. At that time I did not know that M. Becquerel was experimenting in the same direction.

The great lines α, β, γ, less refrangible than the rest, and which M. Lamansky has recently re-detected by the aid of the thermo-multiplier, are given in that drawing. These in the diffraction spectrum must be bands of very considerable width.

2. Sometimes a person is deprived of fair credit for his labour by what may be termed public perversity. I experienced this in the case of the chlorine and hydrogen photometer. The principle of this instrument is, that chlorine and hydrogen obtained in equal volumes by the electrolytic decomposition of hydrochloric acid, are made to reunite by exposure to light. I described a simple instrument of the kind in the *Philosophical Magazine* for December 1843. It still remains the most sensitive f all photo-o meters. Twelve years subsequently, Professors Bunsen and Roscoe modified it, and used it in their photo-chemical researches. In their memoirs, published in the Transactions of the Royal Society, they give full credit for the invention to me, and remark that by its use I had "succeeded in establishing experimentally some of the most important relations of the chemical action of light." They did justice in the matter, but not so the public. The instrument currently passes as their invention, not mine.

While speaking of photometers there is another to which I may allude. It depends on the principle that a solution of ferric oxalate is decomposed with evolution of carbonic acid on exposure to light. The carbonic acid may be measured or weighed by any of the ordinary methods. I described such an instrument in the *Philosophical Magazine*, Sept. 1857. Quite recently M. Marchand has published in his *Annales de Chemie* several experiments by its use, evidently unaware that it had been employed by me many years ago.

3. In 1843 I made photographs of the diffraction spectrum formed by a grating both by reflection and transmission, and published drawings of them. An account of this may be seen in the *Philosophical Magazine* June 1845 and March 1857. These were the first diffraction photographs ever made. They therefore preceded those of M. Mascart by many years. Of course they were not at all comparable with the very fine ones obtained recently by my son, Dr. Henry Draper.

© 1874 Nature Publishing Group